Period_____ Date _____

SECTION 19.1 ACID–BASE THEORIES

This section compares and contrasts acids and bases as defined by the theories of Arrhenius, Brønsted-Lowry, and Lewis. It also identifies conjugate acid–base pairs in acid–base reactions.

Properties of Acids and Bases

1. Circle the letters of all the terms that complete the sentence correctly.
The properties of bases include _____.

a. tasting bitter

b. feeling slippery

c. changing the color of an indicator

d. always acting as a strong electrolyte

2. Circle the letters of all the terms that complete the sentence correctly.
The properties of acids include _____ .

a. reacting with metals to produce oxygen

b. giving foods a sour taste

c. forming solutions that conduct electricity

d. causing indicators to change color

3. Bases are compounds that react with acids to form _____and a(n) _____.

Brønsted-Lowry Acids and Bases

9. How does the Brønsted-Lowry theory define acids and bases?

_____

_____

10. True or false? Some of the acids and bases included in the Arrhenius theory are not acids and bases according to the Brønsted-Lowry theory. _____

11. True or false? A conjugate acid is the particle formed when a base gains a hydrogen ion. _____

12. A conjugate _____is the particle that remains when an acid has donated a hydrogen ion.

13. What is a conjugate acid–base pair? _____

_____

14. A substance that can act as both an acid and a base is said to be_____

15. In a reaction with HCl, is water an acid or a base?_____

CHAPTER 19, Acids, Bases, and Salts *(continued)*

Arrhenius Acids and Bases

4. Match the number of ionizable hydrogens with the type of acid.

_____ one	**a.** diprotic
_____ two	**b.** triprotic
_____ three	**c.** monoprotic

5. True or false? Only the hydrogens in weak polar bonds are ionizable. _____

6. Hydrogen is joined to a very _____ element in a very polar bond.

7. Alkali metals react with water to produce _____ solutions.

8. How do concentrated basic solutions differ from other basic solutions?

Lewis Acids and Bases

16. What is a Lewis acid? _____

17. A Lewis base is a substance that can _____ a pair of electrons to form a covalent bond.

18. true or false? All the acids and bases included in the Brønsted-Lowry theory are also acids and bases according to the Lewis theory. _____

19. Complete this table of acid-base definitions.

Acid- Base Definitions		
Type	**Acid**	**Base**
	H^+ producer	
	electron-pair acceptor	
Brønsted-Lowry		H^+ acceptor

SECTION 19.2 HYDROGEN IONS AND ACIDITY (pages 594–604)

This section classifies solutions as neutral, acidic, or basic, given the hydrogen ion or hydroxide-ion concentration. It explains how to convert hydrogen-ion concentrations into pH values and hydroxide-ion concentrations into pOH values.

Hydrogen Ions from Water

1. What does a water molecule that loses a hydrogen ion become?_____

2. What does a water molecule that gains a hydrogen ion become?_____

3. The reaction in which water molecules produce ions is called the _____ of water.

4. In water or aqueous solution, _____ are always joined

to_____ as hydronium ions (H3O+).

5. True or false? Any aqueous solution in which [H+] and [OH–] are equal is described as a neutral solution.

_____

Ion Product Constant for Water

6. What is the ion-product constant for water (*K*w)? Give the definition, the expression, and the value.

_____

7. A(n) _____ solution is one in which [H+] is greater than [OH–].

A(n) _____ solution is one in which [H+] is less than [OH–].

8. Match the type of solution with its hydrogen-ion concentration.

_____ acidic	**a.** less than 1.0×10^{-7} *M*
_____ neutral	**b .** greater than 1.0×10^{-7} *M*
_____ basic	**c.** 1.0×10^{-7} *M*

The pH Concept

9. The _____ of a solution is the negative logarithm of the hydrogen-ion concentration.

10. Match the type of solution with its pH.

_____ acidic	**a.** pH >7.0
_____ neutral	**b.** pH= 7.0
_____ basic	**c.** pH< 7.0

11. Look at Table 19.5 on page 598. What is the approximate [H+], the [OH−], and the pH of washing soda?

_____

12. The pOH of a solution is the negative logarithm of the _____ concentration.

13. What is the pOH of a neutral solution? _____

14. For pH calculations, in what form should you express the hydrogen-ion concentration? _____

_____

15. Look at the pH scale below. Label where you would find acids, bases, and neutral solutions.

pH

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
10^{0}	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	10^{-10}	10^{-11}	10^{-12}	10^{-13}	10^{-14}

16. True or false? Most pH values are whole numbers._____

17. If [H+] is written in scientific notation but its coefficient is not 1, what do you need to calculate pH?

18. Is the following sentence true or false? You can calculate the hydrogen-ion concentration of a solution if you know the pH. _____

Measuring pH

19. When do you use indicators and when do you use a pH meter to measure pH?

_____

_____

20. Why is an indicator a valuable tool for measuring pH?

_____

_____

21. Why do you need many different indicators to span the entire pH spectrum?

_____

_____

22. Look at the figure below. Fill in the missing pH color change ranges for the indicators.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bromphenol blue															
Bromcresol green															
Phenol Red															
Phenolphthalein															

23. List three characteristics that limit the usefulness of indicators.

a._____

b._____

c._____

24. How accurate are measurements of pH obtained with a pH meter?

_____

25. What is the pH of each of the following solutions?

a. water _____

b. vinegar _____

c. milk of magnesia _____

26. True or false? Measurements of pH obtained with a pH meter are typically accurate to within 0.001 pH unit of the true pH._____

SECTION 19.3 STRENGTHS OF ACIDS AND BASES (pages 605–611)

This section defines strong acids and weak acids, and then explains how to calculate an acid dissociation constant. It describes how acids and bases are arranged by strength according to their dissociation constants (*K*a) *and* (*K*b)*.*

Strong and Weak Acids and Bases

1. What factor is used to classify acids as strong or weak?

_____

2. Strong acids are _____ ionized in aqueous solution; weak acids ionize

_____ in aqueous solution.

3. Look at Table 19.6 on page 605. Which acid is the weakest acid in the table?

_____

Which base is the weakest base?

_____

4. An acid dissociation constant (*K*a) is the ratio of the concentration of the _____ form of an acid to the concentration of the _____ form.

5. What is another name for dissociation constants?

6. True or false? The stronger an acid is, the smaller its *K*a value. _____

7. A diprotic acid has _____ dissociation constants.

8. Weak bases react with water to form the hydroxide ion and the _____ of the base.

9. The words *concentrated* and *dilute* indicate how much acid or base is _____ in solution.

10. True or false? The words strong or weak refer to the extent of ionization or dissociation of an acid or base.

_____

Reading Skill Practice

By looking carefully at photographs and drawings in textbooks, you can better understand what you have read. Look carefully at Figure 19.16 on page 606. What important idea does this drawing communicate? Do your work on a separate sheet of paper. **5 EC pts.**

SECTION 19.4 NEUTRALIZATION REACTIONS

This section explains how acid–base titration is used to calculate the concentration of an acid or a base. It also explains the concept of equivalence in neutralization reactions.

Acid–Base Reactions (pages 612–613)

1. True or false? Acids react with compounds containing hydroxide ions to form water and a salt._____

2. What does the reaction of an acid with a base produce?_____

_____

3. In general, reactions in which an acid and a base react in an aqueous solution to produce a salt and water are called _____ reactions.

4. Look at Table 19.9 on page 613. What are these salts used for?

a. calcium chloride _____

b. silver bromide _____

c. potassium chloride _____

d. sodium chloride _____

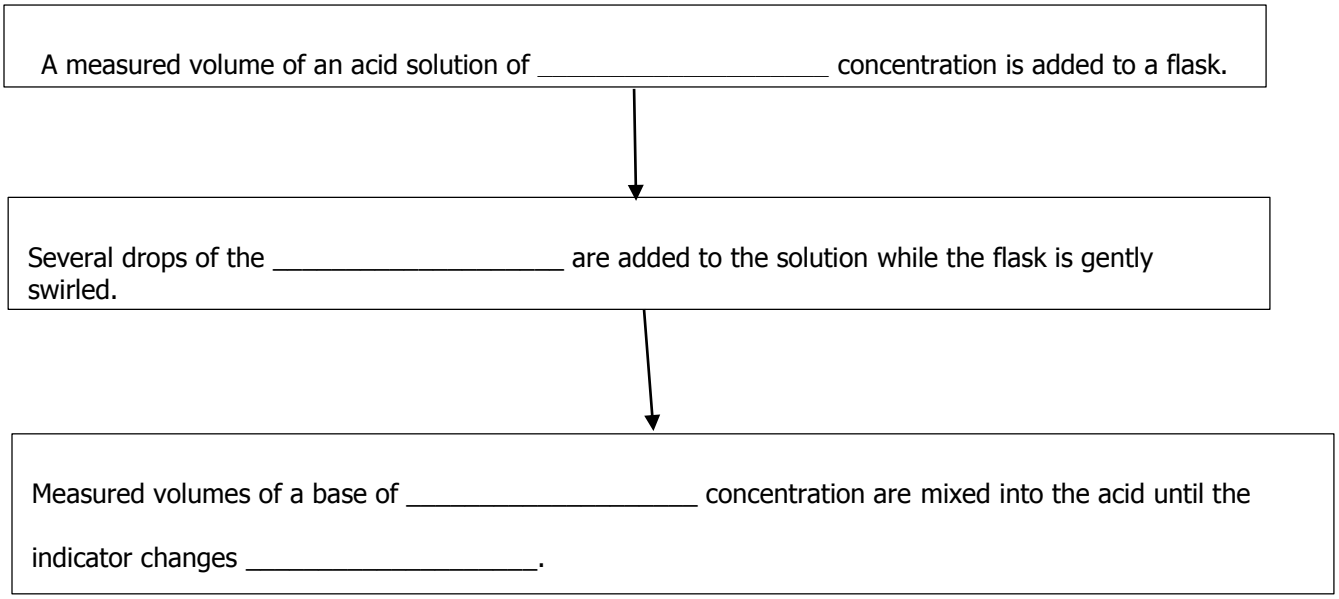
5. Salts are compounds consisting of a(n) _____ from an acid and a(n) _____ from a base.

Titration (pages 613–616)

6. How can you determine the concentration of an acid or base in a solution?_____

_____

7. Complete the flow chart below showing the steps of a neutralization reaction.



8. The process of adding a known amount of solution of known concentration to determine the concentration of another solution is called _____.

9. What is the solution of known concentration called?_____

_____

SECTION 19.5 SALTS IN SOLUTION (pages 618–622)

This section demonstrates with equations how buffers resist changes in pH. It also explains how to calculate the solubility product constant of a slightly soluble salt.

Salt Hydrolysis

1. What is salt hydrolysis?_____

_____

2. Complete this table of the rules for hydrolysis of a salt.

Reactants	Products
_____ acid + _____base	Neutral solution
Strong acid + weak base	_____ solution.
_____ acid + _____base	Basic solution

Buffers

3. What are buffers?_____

_____

4. A buffer is a solution of a _____ acid and one of its salts, or a solution of a _____ base and one of its salts.

5. True or false? The buffer capacity is the amount of acid or base that can be added to a buffer solution before a significant change in pH occurs. _____

